2003 BSAI Other Rockfish

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14.0 Executive Summary

(a) 14.0.1 Summary of Major Changes

Changes in the input data

1. The 2002 landings have been revised and the 2003 landings through October 4th, 2003 have been included in the assessment.
2. Length frequency graphs from the fishery data have been updated for light dusky rockfish and shortspine thornyheads.
3. Length at age data and growth parameters from 2002 AI survey data are included for light dusky rockfish.
4. Weight at length data are reported for light dusky rockfish and shortspine thornyheads.
5. Revision of rockfish species included in other rockfish complex, 20 species removed.
6. Responses to SSC comments and Plan Team recommendations included.

Changes in assessment results

6. Author's recommendation on splitting out SST from the other rockfish complex

Below are the recommended ABC and OFL for Shortspine thornyheads using tier 5 (five year average):

Region	M	Exploitable biomass (t)	ABC (t)	OFL (t)
BSAI	**0.07**	**26,995**		**1,890**
EBS	0.07	17,923	941	
AI	0.07	9,072	476	

Tier 6 estimates for other rockfish (based on average catch 1998-2002 Blend data)

Region	ABC (t)	OFL (t)
BSAI		**474**
EBS	53	
AI	302	

Other rockfish complex Tier 5:

Region	ABC (t)	OFL (t)
BSAI		**82**
EBS	8	
AI	54	

(b) 14.0.2 Responses to SSC Comments

The SSC have not made any specific comments towards the other rockfish assessment.

The SSC made a general comment on rockfish resource management in the BSAI and GOA: *The SSC is concerned that management of multi-species complexes and the management of stocks across the broad geographic areas creates the potential to overfish individual stocks. These undesired outcomes could occur particularly if complex exploitation rates are too high for less productive members of the complex or where spatially discrete local stock aggregations go undetected. … The SSC has expressed concerns about species complex management and individual rockfish species management for several years.* These comments lead to a white paper on rockfish management prepared by Paul Spencer. The 2003 other rockfish stock assessment recommended the splitting out of light dusky rockfish due to a catch higher than the estimated biomass in the EBS. The plan team did not adopt the author's recommendation. Included in the 2004 (this year's) assessment for other rockfish is a recommendation to split out shortspine thornyheads from the other rockfish complex and a preliminary examination as to whether light dusky rockfish are experiencing localized depletion in the EBS.

14.1 Introduction

The other rockfish complex includes all species of Sebastes and Sebastolobus spp. other than Pacific ocean perch (*Sebastes alutus*) and those species in the other red rockfish complex (northern rockfish, *S. polyspinis*; rougheye rockfish, *S. aleutianus*; and shortraker rockfish, *S. borealis*). This complex is one of the rockfish management groups in the Bering Sea and Aleutian Island (BSAI) regions. Eight out of twenty-eight species of "other rockfish" have been confirmed or tentatively identified in catches from the eastern Bering Sea and Aleutian Islands region, thus these are the only species stocks managed in this complex (Reuter and Spencer 2001, NOAA Fisheries 2002 Report to Congress April 2003). These species have been observed at least once in the hauls of the BSAI surveys and/or have occurred in at least 1% of the hauls where an species from the other rockfish category has been caught (Table 14.1). The two most abundant species for this complex are light dusky rockfish (*Sebastes ciliatus sp cf*) and shortspine thornyheads (*Sebastolobus alascancus*)

The distribution of these other rockfish is not well documented in the BSAI regions. Light dusky rockfish are occasionally observed in AFSC research surveys throughout the Aleutian Islands. When observed light dusky rockfish are typically captured between 125 -200m (Reuter and Spencer 2001). Catches of shortspine thornyheads in the Aleutian Island (AI) region are observed around the islands along the bathymetric contours between 200 m and 500 m (Reuter and Spencer 2001). In the Eastern Bering Sea (EBS) light dusky rockfish are rarely encountered in the catches of either the survey or the fishery. Whereas, the shortspine thornyhead distribution is similar to that found in the AI with most encounters occurring in survey and fishery tows deeper than 200 m (Reuter and Spencer 2001).

Recently, in the Aleutian Islands, bycatch of light dusky rockfish is highest near Seguam pass and Petrel Bank. This contrasts the locations where the AFSC AI survey catch light dusky rockfish (Figure 14.2). In the 2000 and 2002 AI surveys, light dusky catch was highest at the western tip of Amchitka Island. (Figure 14.2).

Locations of light dusky rockfish bycatch in the Eastern Bering Sea fisheries are peppered along the slope, and in the region just north of Unalaska Island and Akutan Island in the southern part of the EBS and at the southern tip of Zhemchug canyon in the northern part of the EBS. In the 2002 AI survey, locations of light dusky rockfish catch were similar to fishery bycatch distributions for areas near Unalaska Island and Akutan Island (Reuter and Spencer 2002).

14.1.1 Fishery

Since 1977, rockfish have been identified to the species level in fishery catches by U.S. observers, providing a means of estimating annual harvests of individual species. The two predominant species in the "other rockfish" group are light dusky rockfish (*S. ciliatus*) and shortspine thornyheads (*Sebastolobus alascanus*).

Historical catches of other rockfish since implementation of the MFCMA are shown in Table 14.2. Catches prior to 1990 are assumed to include discards; whereas, catches during the period 1990-2000 explicitly account for discards based on NMFS Regional Office and observer information. The peak catch of other rockfish in the EBS occurred in 1978 with a removal of 2,600 t. In the Aleutian region, peak catch occurred in 1979 with a harvest of 4,500 t. Note that in 2001 removals from the foreign fishery of other rockfish were revised using the current species complex (Reuter and Spencer 2001).

In recent years in both the Aleutian Islands (AI) and eastern Bering Sea (EBS), the bulk of the other rockfish catch was comprised of light dusky rockfish and shortspine thornyheads (Table 14.3). These catches were extrapolated from samples taken by fishery observers (Note: this is not the total harvest for this group). In the AI light dusky rockfish account for 40% (1999) to 65% (2001) of the other rockfish

catch, whereas in the EBS, shortspine thornyhead account for 55% (1998) to 78% (2002) of the other rockfish catch.

The target fisheries that catch these two species are described in Table 14.4. These target fisheries are defined by which species or species group occurred in the greatest abundance based on the total catch of the haul. During 2001 and 2002 in the AI, 76% to 80% of the total light dusky rockfish catch (143t) was caught during the Atka mackerel (*Pleurogrammus monopterygius*) trawl fishery and 33% to 51% of the total shortspine thornyhead catch was caught using longline gear in hauls whose target we describe as "other fish" (grenadiers and/or skates) longline fishery. During the same years in the EBS, 50% of the light dusky rockfish bycatch (10t) was found in hauls designated as the pollock (*Theragra chalcogramma*) pelagic trawl fishery. In 2001 and 2002 hauls described as the Arrowtooth/Kamchatka flounder bottom trawl fishery caught 46% to 66% of the EBS Shortspine thornyhead bycatch.

Other rockfish retained and discarded catch are shown in Table 14.5. In the Aleutian Islands on average 48 % of those species in the other rockfish category were discarded. In the Eastern Bering Sea on average 37 % of those species in the other rockfish category were discarded. The difference in discard rates in these areas may be due to the difference in species composition. Shortspine thornyheads are a higher priced species and are caught mainly by fixed-gear (i.e., higher quality flesh) than light dusky rockfish, and thus may be retained at higher rates (Hiatt, Felthoven and Terry 2002).

14.1.2 Survey

Fishery Independent Surveys and Biomass Estimates

Several bottom trawl surveys provide biomass estimates for the EBS and AI regions. The 1979-86 cooperative U.S.-Japan trawl surveys in the EBS were conducted both on the continental shelf and slope. A majority of catches of other rockfish were taken by Japanese research trawlers working the slope regions at depths exceeding 200 m. In 1991 trawl surveys were conducted in both the EBS and Aleutian regions. These surveys, however, were conducted entirely by domestic trawlers and did not include participation by the deeper-water Japanese research trawlers. The most recent trawl surveys occurred in 1997, 2000 and 2002 in the Aleutian Islands region. Biomass estimates for other rockfish were produced from cooperative U.S.-Japan trawl surveys from 1979-1985 on the eastern Bering Sea slope, and from 1980-1986 in the Aleutian Islands. U.S domestic trawl surveys were conducted in 1988, 1991 and 2002 on the eastern Bering Sea slope, and in 1991,1994, 1997, 2000, and 2002 in the Aleutian Islands (Table 14.6).

In the AI region, the large change in biomass estimates from the 1980-1986 to the 1991-2002 surveys may be due to the differences in vessel type, gear type and survey methodology (Table 14.6). The spatial coverage and survey methods used during 1980 -1986 and 1991 - 2002 were consistent within a time period. Since 1994, the AI groundfish trawl biomass estimates for light dusky rockfish have been stable. The AI groundfish trawl biomass estimates for light dusky rockfish decreased from 1,232 t (CV = 0.31) in 2000 to 445 t in 2002 (CV = 0.29). Since 1994, the AI groundfish trawl biomass estimates for shortspine thornyhead have been increasing. The AI groundfish trawl biomass estimates for shortspine thornyhead increased from 9,813 t (CV = 0.15) in 2000 to 14,243 t (CV = 0.20) in 2002.

The first official EBS slope survey was conducted in 2002 thus biomass estimates from this survey will be used because it provides a better estimate of shortspine thornyhead biomass for this region. It should be noted that only 3 individual light dusky rockfish were caught during the 2002 Bering Sea slope survey. This will be the first biomass of this new time series. The biomass for the EBS group of other rockfish is comprised of 2 components--the EBS shelf-slope component and the Aleutian component of Bering Sea area 1 (Table 14.6).

14.1.3 Data

Fishery

Length frequency

Light dusky rockfish:

Prior to 2002 there is little information regarding the length frequency of light dusky rockfish therefore, the length frequency graphs that are shown in Figure 14.2a may not represent the exploited population. In 2002, observers measured light dusky rockfish when they were encountered. The length distribution of the 2002 collections shows the mean length of fish caught in the fishery (42 cm).

Shortspine thornyheads:

The exploited portion of the population of shortspine thornyhead in the BSAI region are adequately represented and Figure 14.2b shows that individuals between 30 cm and 60 cm are consistently caught by the fishery. The available data do not span a long enough time period to detect any strong year-classes for long-lived species such as shortspine thornyhead rockfish.

Survey

Length frequency

Light dusky rockfish:

Although infrequently encountered during the AI surveys, the length frequency graphs of light dusky rockfish consistently show that mainly fish over 30 cm are captured with this gear type and whose mean length is 39 cm (Figure 14.3).

Shortspine thornyheads:

Length frequency from the AI trawl survey show that the majority of the specimens sampled were between 20 and 50 cm (Figure 14.4). Similar length frequency graphs for shortspine thornyhead are given from the EBS slope surveys (Figure 14.5).

Length at Age

Light dusky rockfish:

The only available age data for light dusky rockfish are from the 2002 AI survey (n=108). Analysis of these data using a von Bertalanffy growth function (Figure 14.6) result in an L_{inf} of 41.6 cm, K=0.32 and a t_o = 2.5. Visual comparison of these results and those from the GOA suggest that light dusky rockfish in the AI are smaller (Clausen and Heifetz 2002).

Shortspine Thornyheads:

No age data exist for SST because an ageing technique has yet to be satisfactorily determined. Current research within the Age and Growth group at the AFSC will provide valuable information in the next two years.

Weight at Length

Weight at length was calculated for Light dusky rockfish and shortspine thornyhead rockfish using the formula $W=aL^b$, where W is weight in grams and L is fork length in mm.

Species	Data source	Years sampled	Area	a	b	Sample size
Light Dusky	Survey	2002	AI	3×10^{-6}	3.28	84
SST	Survey	83, 86, 91, 94, 97, 00, 02	AI	4.8×10^{-3}	3.3	3,045
SST	Fishery	99, 00, 01, 02	AI	5×10^{-6}	3.2	186
SST	Fishery	99, 00, 02	EBS	8×10^{-5}	2.4	50

14.2 Assessment methods

In the AI the exploitable biomass estimate is the average of the most recent surveys, in this year's stock assessment those are the 1991, 1994, 1997, 2000 and 2002 AI surveys. The EBS is divided into two areas when determining the biomass of the other rockfish category, the shelf/slope area and the southern Bering Sea. Historically, the shelf area of the EBS has not had a useable biomass estimate for other rockfish, the EBS slope area has a biomass estimate for 2002 from the 2002 slope survey (the first time since 1991) and the southern Bering Sea biomass estimate is attained on those years when the AI survey occurs (Table 14.6). For the latter portion of the EBS the exploitable biomass estimate that is used in this assessment is the average of the most recent surveys (1991, 1994, 1997, 2000 and 2002 plus the 2002 EBS slope survey estimate). The past slope surveys were not averaged due to the distinct differences of the surveys, thus it was decided to use only the 2002 survey as a stand alone estimate.

Recent survey data indicate that shortspine thornyhead, light dusky rockfish and harlequin rockfish make up the bulk of the survey catches of other rockfish. The most recent survey estimates indicate that ~ 90% of the other rockfish biomass is comprised of shortspine thornyhead (Table 14.7). For this reason it is recommended that SST are separated from the other rockfish complex and managed as a tier 5 stock, whereas the other rockfish stock will be downgraded to a tier 6 stock pending better biomass estimates (see section 14.7).

14.3 Results

Reference fishing mortality rates and yields

Information is lacking to calculate reference fishing mortality rates and yields that directly conserve spawning stock biomass. Harvest recommendations for EBS and AI other rockfish in the past have been based on Tier 5 methods. Historically, the value of M (0.07) has been used to assess the other rockfish stock, which represents an approximation based on knowledge of rockfish life histories from other areas. This value is based on the estimate for shortspine thornyheads (Ianelli and Ito 1994) since this species evidently comprises well over 90% of the other rockfish biomass (as calculated by survey data). Below are the author recommendations for 2003:

The 2002 other rockfish assessment recommended splitting light dusky rockfish out of this complex due to the uncertainty of the stock's health and its biomass estimate (Reuter and Spencer 2002). The uncertainty in the survey biomass estimates of light dusky rockfish in the EBS (2002 slope survey CV=0.56) led the Plan Team to not recommend splitting them out of the other rockfish category. It was suggested during the Plan Team meeting to consider future management of light dusky rockfish as a tier 6 stock in future assessments. In this assessment we recommend splitting SST from the other rockfish complex because this species is demographically different than the rest of the complex and the biomass estimates for this species has lower uncertainty (average CV of last 5 AI survey = 0.18) than those for the other rockfish species within the complex (average CV of last 5 AI survey = 0.42) (see Table 14.8). Under the tier 6 system, OFL is estimated by the average catch and the ABC is 75% of the OFL (OFL = avg. catch; ABC = 0.75 x OFL). Due to the lack of species specific data prior to 1996, the following is an average of the blend catch data from 1998-2002 (Avg. Catch = $\sum$(Total OR blend – Estimated SST catch)/5). Due to lack of information on stock structure, genetic and otherwise, it is recommended that there be a BSAI OFL for both SST and other rockfish, separate OFLs are given as a reference. The tier 5 scenario for the AI is given as reference, it uses an M of 0.09 which is the M for Light dusky rockfish in the GOA (Clausen and Heifetz 2002).

Other rockfish complex Tier 6:

Region	ABC (t)	OFL (t)
BSAI		**474**
EBS	53	
AI	302	

Other rockfish complex Tier 5:

Region	ABC (t)	OFL (t)
BSAI		**82**
EBS	8	
AI	54	

For SST, Under tier 5 of Amendment 56, a fishing mortality rate equal to 75% of the natural mortality rate is the maximum allowable F (ABC) value. Therefore, the estimate of ABC for the eastern Bering Sea region is 941 t (0.75 x 0.07 x 17,923 t) and 476 t (0.75 x 0.07 x 9,072 t) for the Aleutian Islands region.

Based on the overfishing definition, the overfishing level (OFL) is computed assuming $F_{OFL} = M$. Thus, the overfishing level for the eastern Bering Sea region is 1,255 t and 635 t for the Aleutian Islands region.

Region	M	Exploitable biomass (t)	ABC (t)	OFL (t)
BSAI	**0.07**	**26,995**		**1,890**
EBS	0.07	17,923	941	
AI	0.07	9,072	476	

During the 2002 Plan Team meetings it was suggested to look at the possibility of localized depletion of light dusky rockfish stocks in the EBS. Locations were described in the AI and EBS where light dusky rockfish were consistently caught from 2000-2002 within observed fishery hauls. In the AI, seven areas were chosen to check for localized depletion (Figure 14.7a) and in the EBS 4 areas were chosen and two more areas were added using 2 years of data (Figure 14.7b). To determine depletion within these areas, CPUE (kg/hr) per year was used as a preliminary indicator (Figure 14.8). Although localized depletion could not be detected using the above methods, it is interesting to note that light dusky rockfish behavior is different in the EBS than in the AI. In the AI, approximately 80% of the light dusky catch could be explained within the seven areas (figure 14.9a) whereas in the EBS only 40% of the light dusky catch was found within the six areas. This information may suggest that light dusky rockfish are less aggregated in the EBS than in the AI, and the distribution and availability of preferred light dusky rockfish habitat is different. This preliminary study may be used to further research alternative harvest strategies for species such as light dusky rockfish, who are data-limited and have potentially sensitive life history characteristics.

14.4 Ecosystem Considerations

14.4.1 Ecosystem Effects on Stock

Little to no information is available that would help us understand the effects the ecosystem has on the other rockfish complex. The table below goes over the most probable affects of the ecosystem on the other rockfish complex.

14.4.2 Fishery Effects on the Ecosystem

Analysis of ecosystem considerations for those fisheries that effect the stocks within this complex (see Table 14.4) is given in the respective fisheries SAFE chapter. The other rockfish complex is not a targeted fishery, therefore reference on the effects of the fishery on the ecosystem will be described in those chapters of the fisheries that catch other rockfish incidentally.

Ecosystem effects on *Other Rockfish*			
Indicator	Observation	Interpretation	Evaluation
Prey availability or abundance trends			
Zooplankton	Stomach contents, ichthyoplankton surveys, changes mean wt-at-age	Data non-existent	Unknown
a. Predator population trends			
Marine mammals	Fur seals declining, Steller sea lions increasing slightly	No affect	Probably no concern
Birds	Stable, some increasing some decreasing	No affect	Probably no concern
Fish (Pollock, Pacific cod, halibut)	Stable to increasing	Affects not known	Probably no concern
b. Changes in habitat quality			
Temperature regime	None	Affects not known	Unknown
Winter-spring environmental conditions	None	Probably a number of factors	Unknown
Production	Fairly stable nutrient flow from upwelled BS Basin	Inter-annual variability low	No concern
***Targeted fisheries* effects on ecosystem (see relative chapters)**			

14.4.3 Data gaps and research priorities

Data needed to better understand the life history characteristics, spatial distribution and abundance are those most important in deciding creative management strategies for non-target species. These are the types of data missing for all the species within the other rockfish complex and for SST. These data types include but are not limited to: age data from the fishery for light dusky rockfish; spatial and temporal length data from AI fishery for light dusky rockfish; improved spatial distribution and abundance data of other rockfish; ageing techniques for SST.

Research priorities for the other rockfish complex and SST are analyses that utilize the above data to suggest stock health, potential fishery impacts and provide suggestions to mitigate concerns on conservation of the stock and localized depletion. Creation of an SST model similar to that used in the GOA is suggested to analyze the potential utility in model results for assessing stock health. Currently, the age and growth group are assessing ageing techniques for SST.

14.5 Summary

A summary of the estimates of current exploitable biomass and ABC for the other rockfish group in the EBS and Aleutian Islands region is provided in the following table:

Due to the uncertainty of the biomass estimates for species within the other rockfish complex other than shortspine thornyheads, the authors recommend separating the SST from the other rockfish complex. The rest of the species in the other rockfish complex will then be managed using the tier 6 approach.

Below are the recommended ABC and OFL for Shortspine thornyheads using tier 5 (five year average):

Region	M	Exploitable biomass (t)	ABC (t)	OFL (t)
BSAI	**0.07**	**26,995**		**1,890**
EBS	0.07	17,923	941	
AI	0.07	9,072	476	

Tier 6 estimates for other rockfish (based on average catch 1998-2002 Blend data)

Region	ABC (t)	OFL (t)
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AI	302	

Other rockfish complex Tier 5:

Region	ABC (t)	OFL (t)
BSAI		**82**
EBS	8	
AI	54	

14.06 Literature Cited

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Table 14.1. The common and scientific names of rockfish in the "other rockfish" reporting category identified, 1990 - 2001, by AFSC research surveys (at least one observation) and U.S. fishery observers (greater than 1% of hauls) in the eastern Bering Sea and Aleutian Islands regions. (~ = none observed, percent of hauls where other rockfish occurred)

		EBS		AI	
Common name	Scientific name	**Survey**	**Fishery**	**Survey**	**Fishery**
Red banded rockfish	*Sebastes babcocki*	~	~	*1%*	*<1%*
Dark dusky rockfish	*Sebastes ciliatus*	~	*1%*	*4%*	*3%*
Light dusky rockfish	*Sebastes ciliatus sp cf*	*18%*	*39%*	*22%*	*45%*
Redstripe rockfish	*Sebastes proriger*	~	*1%*	~	*1%*
Yelloweye rockfish	*Sebastes ruberrimus*	~	*1%*	*<1%*	*1%*
Harlequin rockfish	*Sebastes variegatus*	~	*1%*	*9%*	*5%*
Sharpchin rockfish	*Sebastes zacentrus*	~	*<1%*	*<1%*	*<1%*
Shortspine thornyhead	*Sebastolobus alascanus*	*62%*	*43%*	*61%*	*34%*

Table 14.2.--Summary of catches (t) of other rockfish in the eastern Bering Sea and Aleutian Islands regions. Source: NMFS/AK regional website.

	Eastern Bering Sea						Aleutian Islands					
	Domestic						Domestic					
Year	For.	JV	DAP	Total	ABC	OFL	For.	JV	DAP	Total	ABC	OFL
1977*	112	--	--	112			700	--	--	700		
1978*	941	--	--	941			212	--	--	212		
1979*	759	--	--	759			1,039	--	--	1,039		
1980	456	3	--	459			420	--	--	420		
1981	331	--	25	356			328	--	--	328		
1982	262	11	3	276			2,114	--	--	2,114		
1983	212	8	--	220			1,041	4	--	1,045		
1984	121	8	47	176			42	14	--	56		
1985	33	3	56	92			2	14	83	99		
1986	4	12	86	102			Tr	15	154	169		
1987	3	4	467	474			0	6	141	147		
1988	0	8	333	341			0	68	210	278		
1989	0	4	188	192			0	0	481	481		
1990	0	0	418	418			0	0	858	858		
1991	0	0	422	422			0	0	343	343		
1992	0	0	600	600			0	0	664	664		
1993	0	0	192	192			0	0	496	496		
1994	0	0	133	133			0	0	292	292		
1995	0	0	288	288			0	0	219	219		
1996	0	0	170	170			0	0	282	282		
1997	0	0	163	163			0	0	305	305		
1998	0	0	188	188			0	0	364	364		
1999	0	0	135	135			0	0	631	631		
2000	0	0	232	232	369	492	0	0	563	563	685	913
2001	0	0	295	295	361	482	0	0	592	592	676	901
2002	0	0	398	398	361	482	0	0	518	518	676	901
2003§	0	0	308	308	960	1,280	0	0	378	378	634	846

* These biomass estimates were revised (2001) to show the catch of those species currently in the other rockfish category.

§ Estimated removals through October 4th, 2003.

Table 14.3. Observed fishery catch (t) of top species in other rockfish group in the Aleutian Islands and eastern Bering Sea from 1999-2003. *Source: North Pacific Observer Database AFSC Seattle WA.*

Aleutian Islands

2003*	E	C	W	Total
Light Dusky	9	40	56	**105**
Shortspine	15	26	16	**57**
Thorny unid.	9	2	10	**21**
Harlequin	5	11	1	**17**
Total	**38**	**79**	**83**	**200**

2002	E	C	W	Total
Light Dusky	40	67	83	**190**
Shortspine	37	17	14	**68**
Thorny unid.	10	6	1	**17**
Harlequin	18	18	5	**41**
Rockfish unid.	12	2	5	**19**
Total	**117**	**110**	**108**	**335**

2001	E	C	W	Total
Light Dusky	145	63	44	**252**
Shortspine	20	13	8	**41**
Harlequin	3	8	12	**23**
Dark Dusky	1	5	4	**10**
Thorny unid.	8	< 1	< 1	**8**
Total	**182.5**	**93**	**112**	**387.5**

2000	E	C	W	Total
Light Dusky	192	65	6	**263**
Shortspine	46	22	19	**87**
Rockfish unid.	6	26	2	**34**
Harlequin	12	14	2	**28**
Redstripe	<1	<1	8	**8**
Total	**256**	**127**	**37**	**420**

1999	E	C	W	Total
Light Dusky	158	27	7	**191**
Rockfish unid.	105	13	2	**120**
Shortspine	24	21	16	**61**
Redstripe	<1	18	29	**47**
Harlequin	2	6	13	**21**
Thorny unid.	8	9	3	**20**
Dark Dusky	5	9	3	**17**
Total	**302**	**103**	**73**	**477**

*Observed catch as of October 20, 2003

Eastern Bering Sea

2003*	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	12	111	**123**
Light Dusky	3	8	**11**
Thorny unid.	4	8	**12**
Rockfish unid.	4	9	**13**
Total	**23**	**136**	**159**

2002	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	11	108	**119**
Light Dusky	9	14	**23**
Redstripe	0	4	**4**
Rockfish unid.	3	3	**6**
Total	**23**	**129**	**152**

2001	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	7.5	96	**104**
Light Dusky	4	18	**22**
Thorny unid.	3.5	5.5	**9**
Rockfish unid.	2	5	**7**
Total	**15**	**120**	**135**

2000	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	13	71	**84**
Light Dusky	6	11	**17**
Rockfish unid.	10	2	**12**
broad banded thorny.	4	< 1	**4**
dark dusky	2	2	**4**
Total	**35**	**86**	**121**

1999	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	10	28	**38**
Light Dusky	2	16	**18**
Rockfish unid.	3	3	**6**
Small Red Rockfish Group	<1	3	**3**
Thornyhead unid.	1	3	**4**
Total	16	53	**69**

*Observed catch as of October 20, 2003

Table 14.4. Catch (t) of Light dusky rockfish and Shortspine thornyhead by target fishery and gear type for 2002, and 2001. *Source: NorPac Database AFSC Seattle WA.*

2002

Aleutian Islands

Light dusky rockfish

	Geartype			
Target fishery	**Trawl**	**Pot**	**Longline**	**Total**
Atka Mackerel	143	-	<1	**143**
Pacific Cod	10	-	7	**17**
POP	16	-	-	**16**
Northern rockfish	11	-	-	**11**
Total	**180**	**-**	**7**	**187**

Shortspine thornyhead

	Geartype			
Target fishery	**Trawl**	**Pot**	**Longline**	**Total**
Other Fish	<1	<1	29	**29**
POP	19	-	-	**19**
Sablefish	-	<1	9	**9**
Total	**19**	**<1**	**38**	**57**

Eastern Bering Sea

Light dusky rockfish

	Gear type				
Target fishery	**Bottom trawl**	**Pelagic trawl**	**Pot**	**Longline**	**Total**
Pollock	<1	10	-	-	**10**
Pacific Cod	1	-	<1	7	**8**
Light dusky	3	-	-	<1	**3**
Total	**4**	**10**	**<1**	**7**	**21**

Shortspine thornyhead

	Gear type				
Target fishery	**Bottom Trawl**	**Pelagic trawl**	**Pot**	**Longline**	**Total**
Arrowtooth/ Kamchaka	53	-	<1	< 1	**53**
Greenland Turbot	23	-	<1	9	**32**
Other Fish	13	-	<1	6	**19**
SST	12	-	-	-	**12**
Total	**101**	**-**	**<1**	**15**	**116**

*Other fish target made up mainly of grenadiers and/or skates

2001

Aleutian Islands

Light dusky rockfish

	Geartype			
Target fishery	**Trawl**	**Pot**	**Longline**	**Total**
Atka Mackerel	194	-	-	**194**
Pacific Cod	7	< 1	30	**38**
Northern rockfish	11	-	< 1	**11**
Total	**212**	**< 1**	**30**	**243**

Shortspine thornyhead

	Geartype			
Target fishery	**Trawl**	**Pot**	**Longline**	**Total**
Sablefish	-	<1	9	**9**
Other Fish	-	<1	9	**9**
POP	9	-	-	**9**
Total	**9**	**<1**	**18**	**27**

Eastern Bering Sea

Light dusky rockfish

	Gear type				
Target fishery	**Bottom trawl**	**Pelagic trawl**	**Pot**	**Longline**	**Total**
Pollock	1	9	-	-	**10**
Northern rockfish	6	-	-	-	**6**
Pacific Cod	<1	5	-	-	**5**
Total	**7**	**14**	**-**	**-**	**21**

Shortspine thornyhead

	Gear type				
Target fishery	**Bottom Trawl**	**Pelagic trawl**	**Pot**	**Longline**	**Total**
Arrowtooth/ Kamchaka	67	-	-	< 1	**68**
Greenland Turbot	16	-	-	5	**21**
Pollock	<1	5	-	-	**5**
Flathead Sole	4	-	-	-	**4**
Other Fish	1	-	< 1	3	**4**
Total	**88**	**5**	**< 1**	**8**	**102**

*Other fish target made up mainly of grenadiers and/or skates

Table 14.5. Other rockfish retained and discarded catch (mt) for the Aleutian Islands and the Eastern Bering Sea 1995-2001. *Source: NMFS AK Region website.*

Other Rockfish

AI	Retained	Discarded	Total	Percent Discarded
1995	144	75	219	34
1996	155	127	282	45
1997	153	152	305	50
1998	127	237	364	65
1999	250	381	631	60
2000	340	223	563	40
2001	319	272	591	46
2002	267	250	517	48

EBS

1995	126	162	288	56
1996	97	73	170	43
1997	107	56	163	34
1998	120	67	187	36
1999	78	57	135	42
2000	167	65	232	28
2001	237	57	294	19
2002	286	113	399	28

Table 14.6. Estimated biomass (t) of "other rockfish" from the NMFS bottom trawl surveys. Coefficient of variation in parenthesis.

	Eastern Bering Sea (EBS)		
	EBS slope	Aleutians portion of EBS Area 1	Aleutian Region
1979	3,251	--	--
1980	--	1,095	19,078
1981	4,975	--	--
1982	4,381	--	--
1983	--	1,696	15,995
1984	--	--	--
1985	5,127	--	--
1986	--	5,187	20,336
1987	--	--	--
1988	8,759	--	--
1989	--	--	--
1990	--	--	--
1991	4,529	246 (0.49)	6,668 (0.22)
1992	--	--	--
1993	--	--	--
1994	--	1,171 (0.48)	6,449 (0.16)
1995	--	--	--
1996	--	--	--
1997	--	1,683 (0.63)	10,063 (0.17)
1998	--	--	--
1999	--	--	--
2000	--*	1,107 (0.45)	11,170 (0.14)
2001	--	--	--
2002	16,988 (0.11)	1,116 (0.37)	15,029 (0.03)
2003	--	--	--

*Biomass estimates from the 2000 EBS slope survey were not used in stock assessment.

Table 14.7. Biomass estimates (t) of the main species from the other rockfish group caught during the most recent Aleutian Islands surveys; by species, year and management area. CVs noted in parentheses. *Note: Biomass totals are slightly different than for Other rockfish category.*

2002	E	C	W	Total AI	Southern BS	EBS Slope	Total BSAI
Shortspine thornyheads	543	5,454	8,246	14,243	1,012	16,932 (.11)	**32,187**
Light Dusky	149	261	36	446	97	25 (.56)	**568**
Dark Dusky	0	0	318	318	5		**323**
Total				**15,007**	**1,114**	**16,957**	**33,078**

2000	E	C	W	Total AI	Southern BS	EBS Slope§	Total BSAI
Shortspine thornyheads	522	3,815	5,476	9,813	1,051		**10,689**
Light Dusky	468	579	186	1,233	55		**1,288**
Dark Dusky	0	0	99	99	0		**99**
Harlequin	8	15	3	26	0		**26**
Total				**11,171**	**1,116**		**12,102**

1997	E	C	W	Total AI	Southern BS	EBS Slope§	Total BSAI
Shortspine thornyheads	159	2,011	6,726	8,896	1,545		**10,441**
Light Dusky	442	78	54	574	138		**712**
Dark Dusky	32	10	482	524	0		**524**
Harlequin	5	53	10	68	0		**68**
Total				**10,062**	**1,683**		**11,745**

1994	E	C	W	Total AI	Southern BS	EBS Slope§	Total BSAI
Shortspine thornyheads	187	1,554	4,499	6,240	1,071		**7,311**
Light Dusky*	7	51	31	89	97		**186**
Dark Dusky*	0	1	101	102	2		**104**
Harlequin	5	12	1	18	2		**20**
Total				**6,449**	**1,172**		**7,621**

1991	E	C	W	Total AI	Southern BS	EBS Slope	Total BSAI
Shortspine thornyheads	115	908	5,143	6,166	187	4,521	**11,785**
Light Dusky*	123	338	3	339	57	7	**621**
Dark Dusky*	4	4	9	17	1		**18**
Harlequin	2	14	4	20	0		**20**
Total				**6,542**	**245**	**4,528**	**12,444**

* 1991 and 1994 light and dark dusky biomass determined by proportion (based on 3 more recent survey data) of "dusky" catch. § No EBS slope survey

Table 14.8 Biomass estimates and Coefficient of variation, in parentheses, for SST and remaining species in Other rockfish complex used for estimating OFL and ABC.

Aleutian Islands

	1991	1994	1997	2000	2002
SST	6,165 (0.24)	6,240 (0.16)	8,896 (0.18)	9,813 (0.15)	14,243 (0.20)
Other rockfish	502 (0.39)	209 (0.61)	1,165 (0.46)	1,357 (0.32)	785 (0.30)

Southern Bering Sea

	1991	1994	1997	2000	2002
SST	187 (0.58)	1,071 (0.52)	1,545 (0.68)	1,051 (0.48)	1,012 (0.40)
Other rockfish	58 (0.88)	100 (0.49)	138 (0.46)	55 (0.36)	104 (0.34)

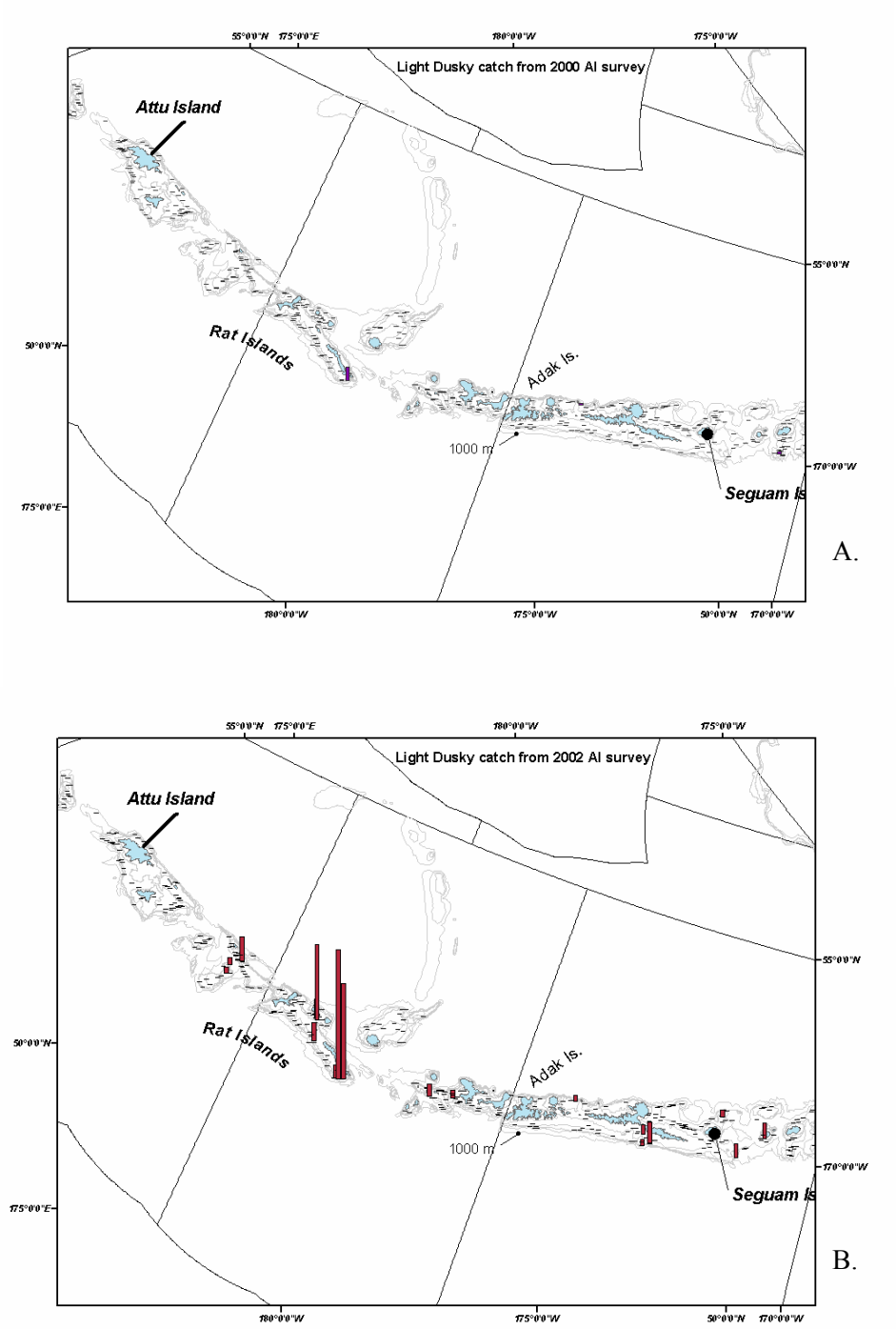


Figure 14.1. Light Dusky catch locations in the Aleutian Islands from survey data A. 2000 and B. 2002, (data source: AFSC RACE database). *Note: Bars from different years are proportional.*

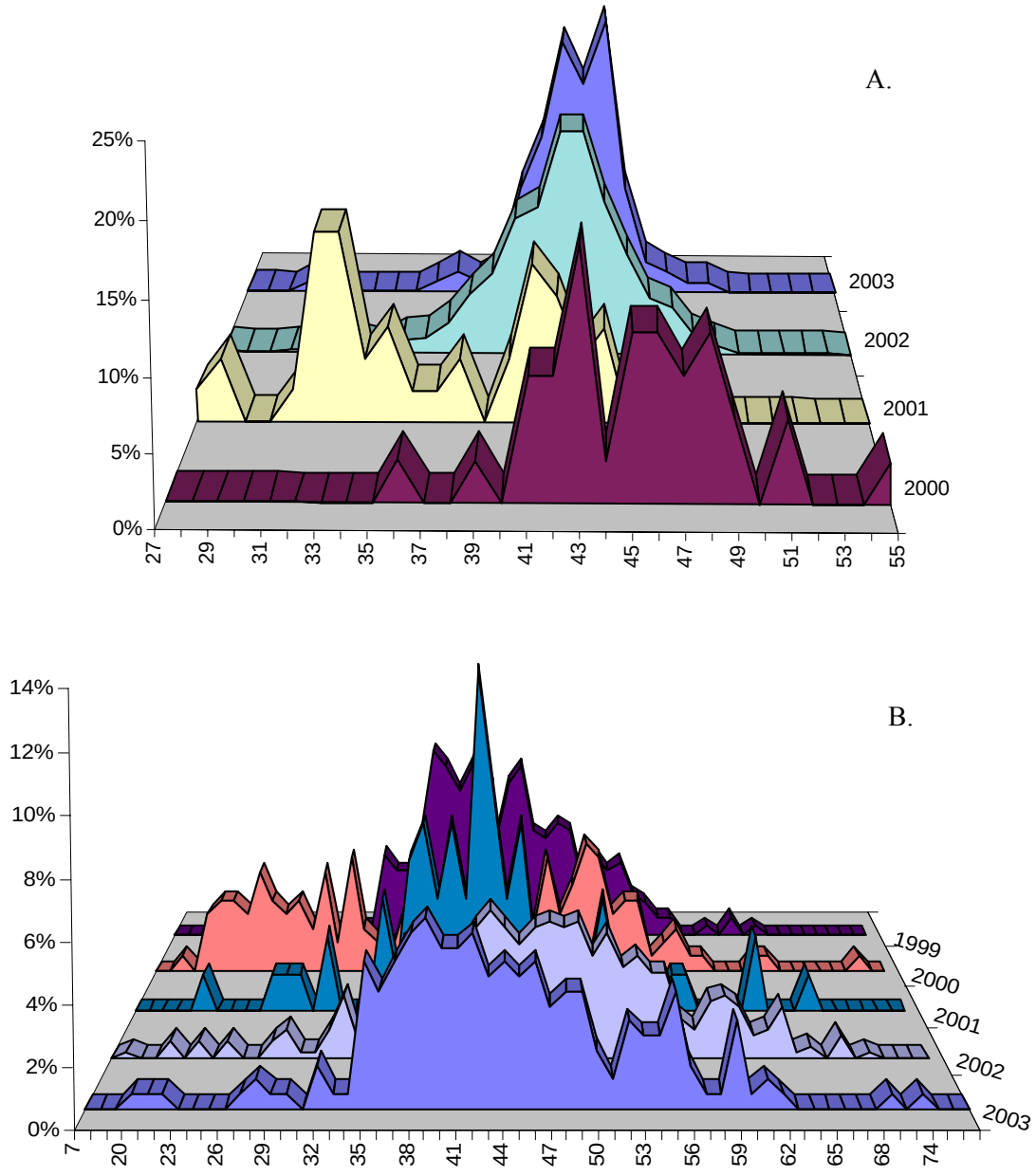


Figure 14.2. Length frequency of A. Light dusky rockfish and B. Shortspine thornyhead from fishery data in the Aleutian Islands.
Source: NorPac Database AFSC Seattle WA.

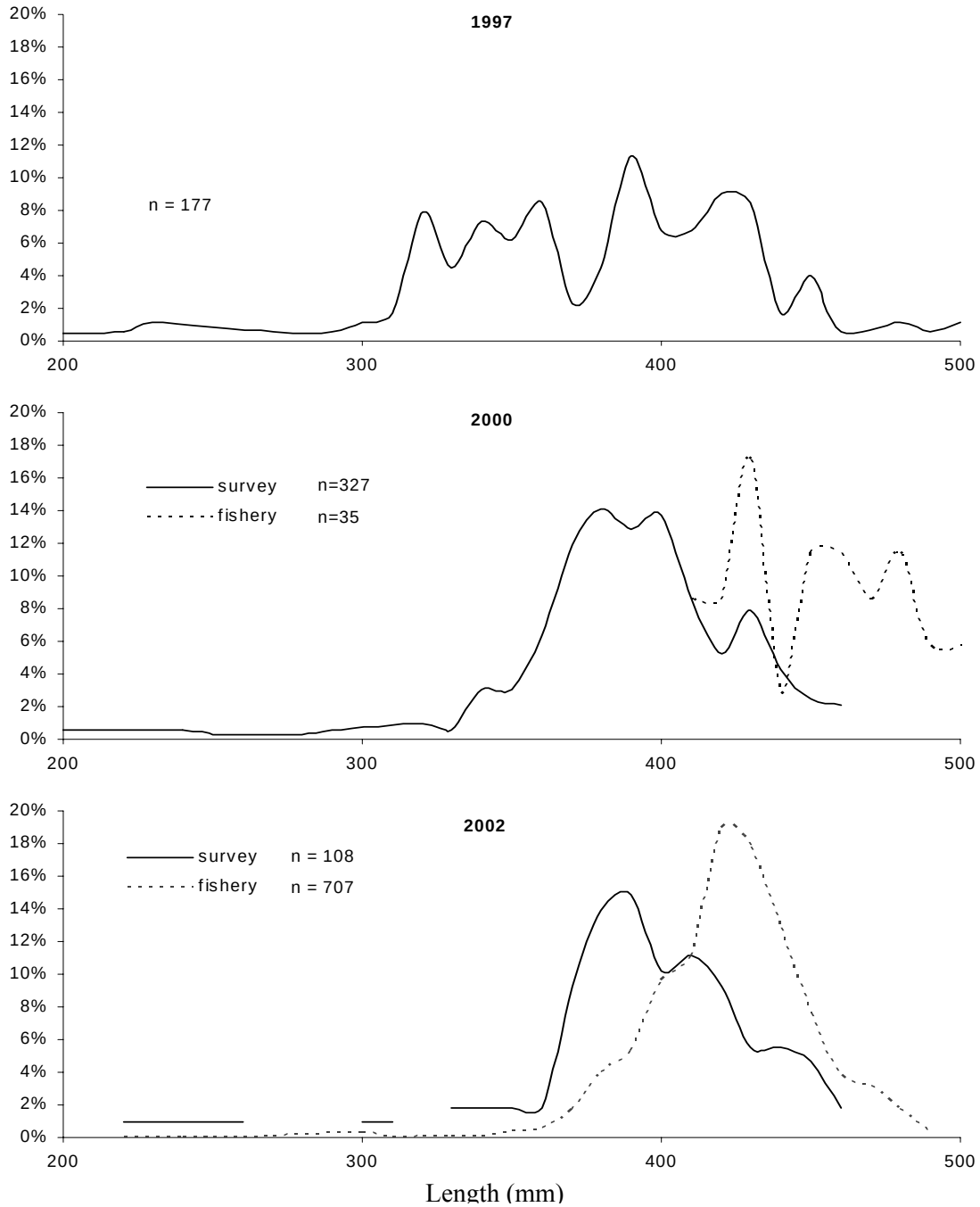


Figure 14.3. Length frequency (mm) for light dusky rockfish from the Aleutian Islands research surveys. Fishery data included when available. *Source: AFSC RACE survey data*.

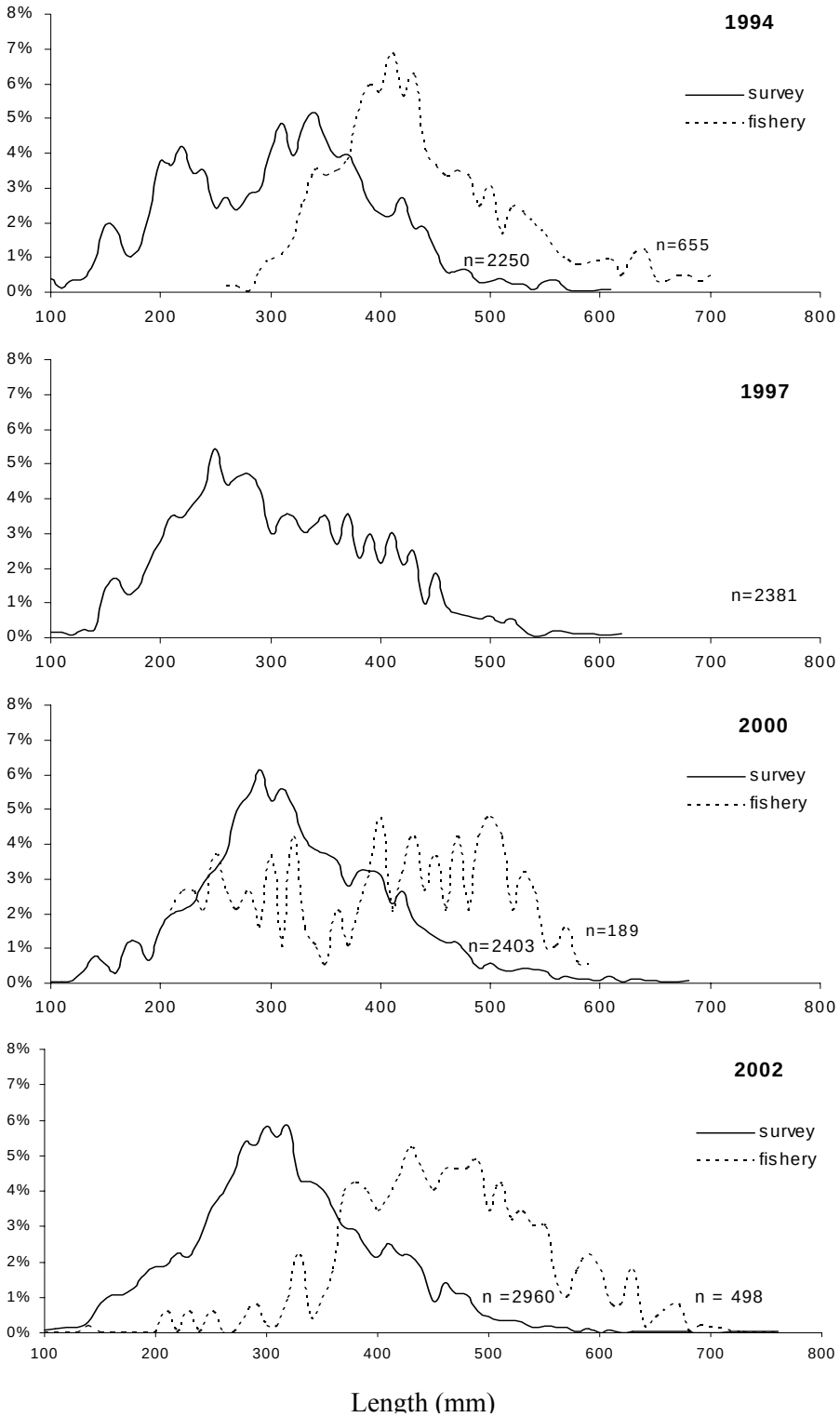


Figure 14.4. Length frequency (mm) for shortspine thornyhead from the Aleutian Islands research surveys. Fishery data included when available. *Source: AFSC RACE survey data.*

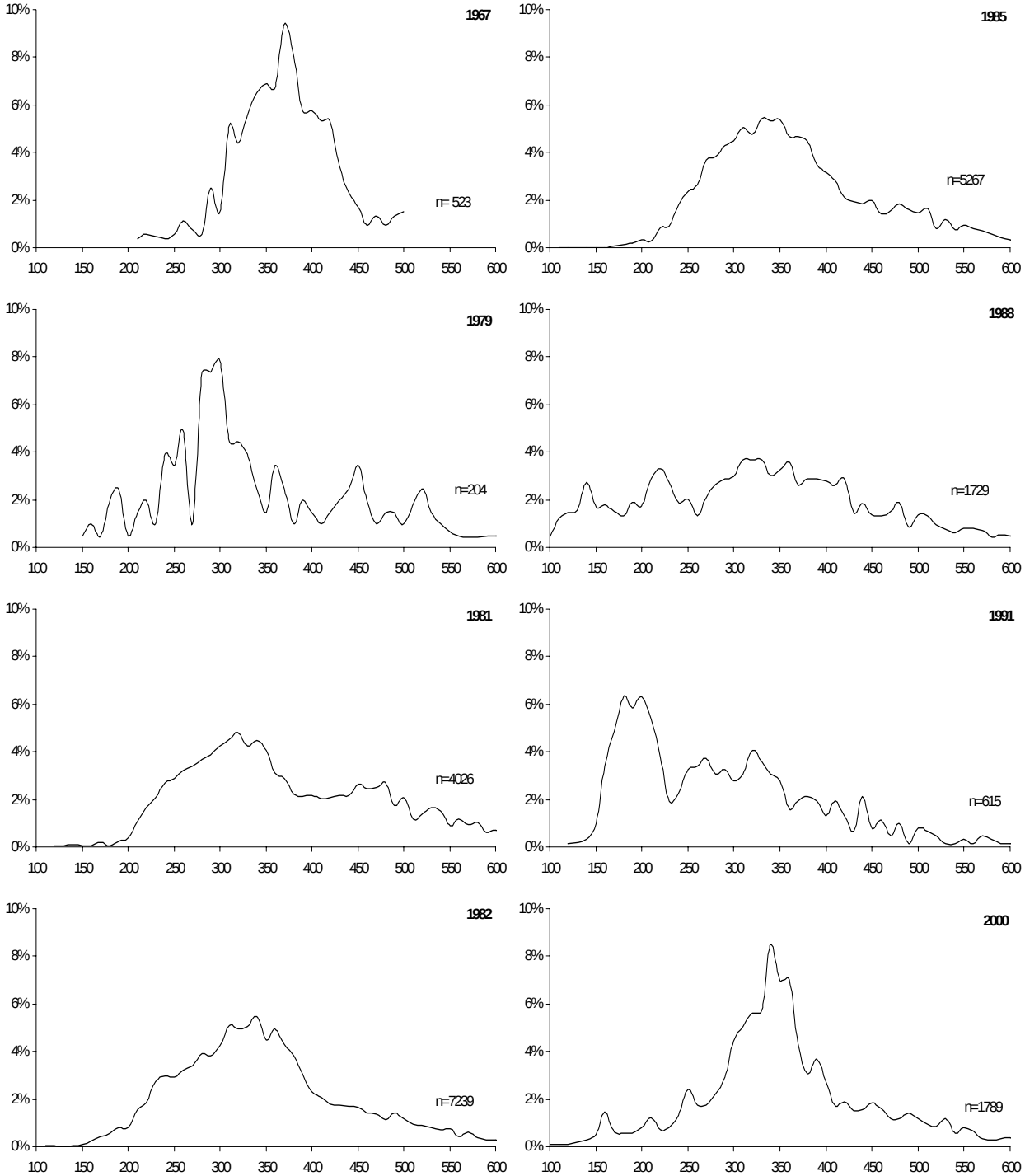


Figure 14.5. Length frequency (mm) for shortspine thornyhead from the Eastern Bering Sea research surveys. *Source: AFSC RACE survey data.*

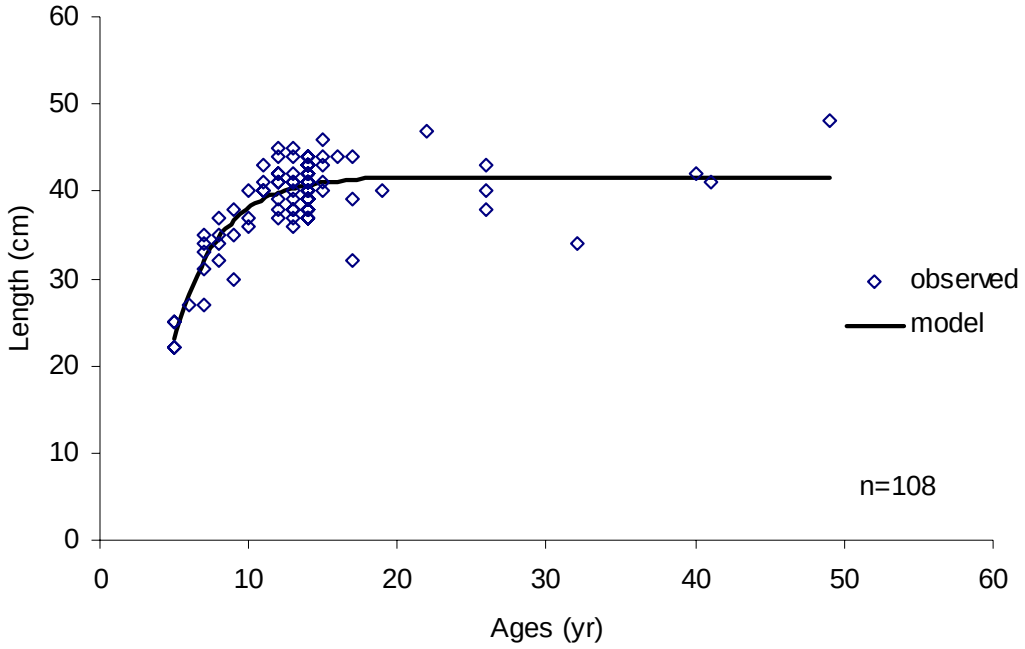
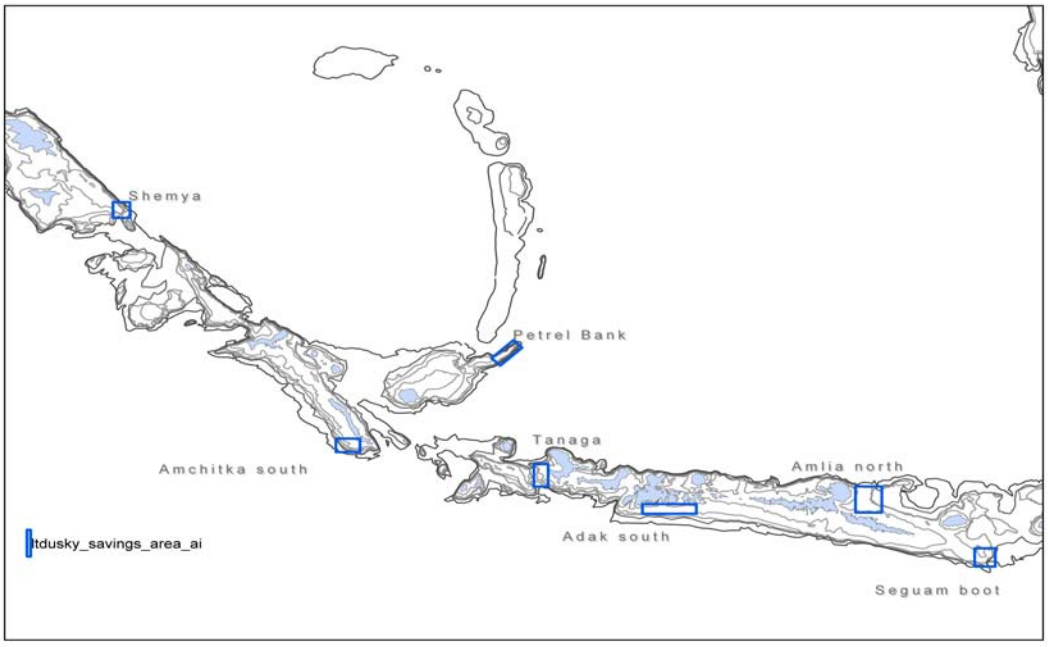
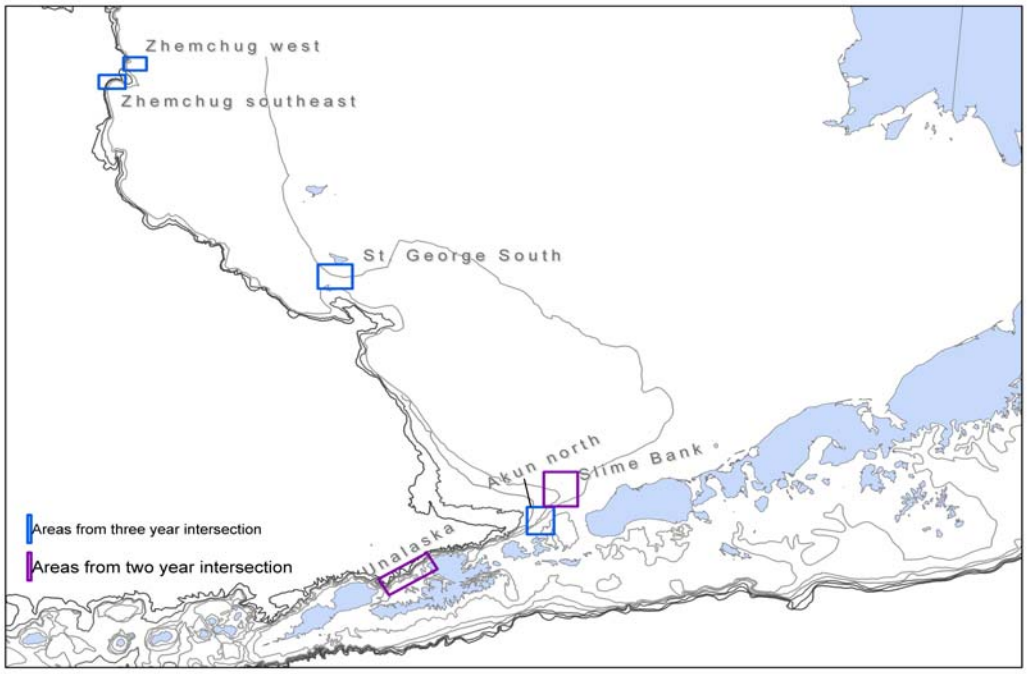


Figure 14.6. Age and growth curve of Light dusky rockfish in the Aleutian Islands. Data source from 2002 AI survey.



A



B

Figure 14.7: Locations where light dusky rockfish were consistently caught in observed fishery hauls from 2000-2002: A. Aleutian Islands B. Eastern Bering Sea. These locations were used to determine if localized depletion occurs.

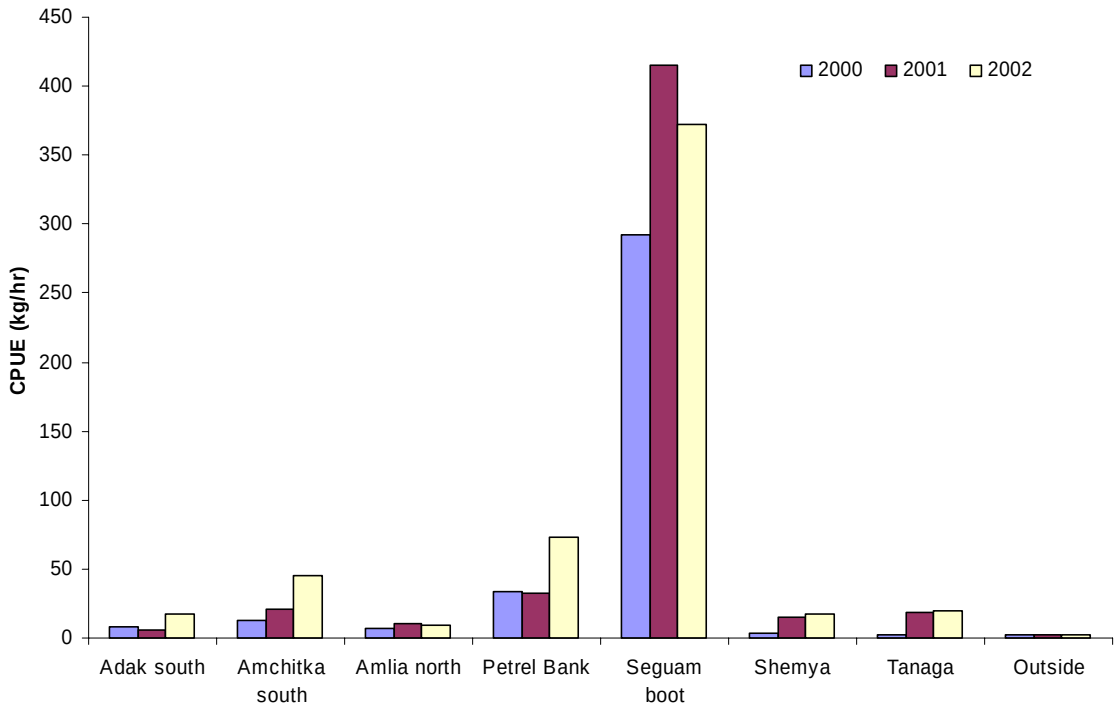


Figure 14.8a. CPUE (kg/hr) by year of Lt. Dusky in AI areas.

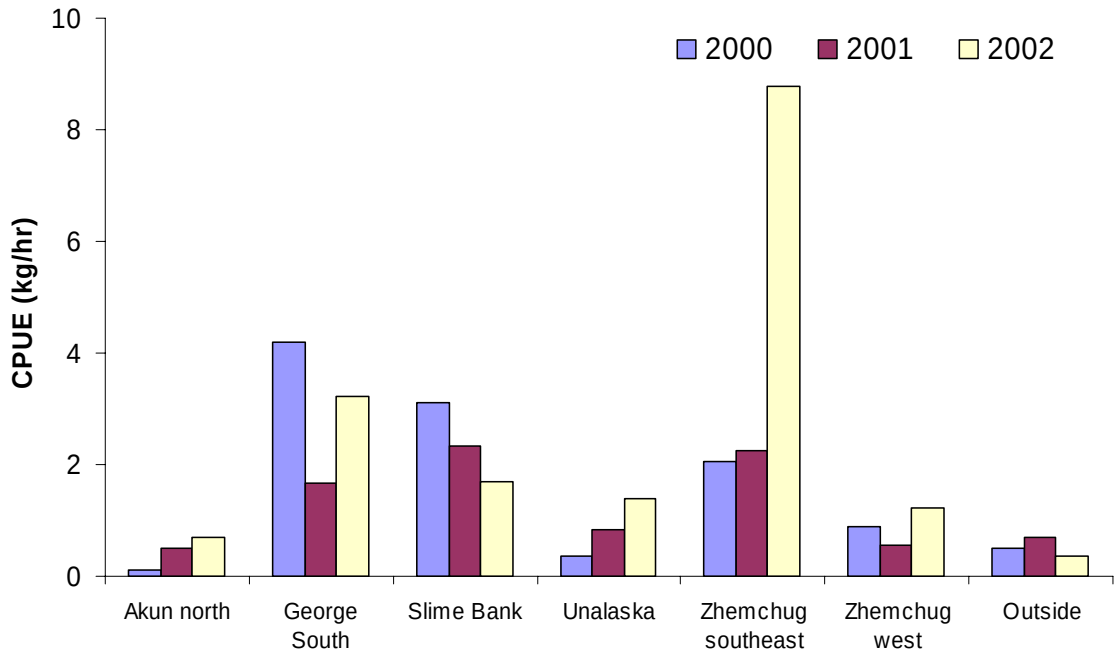


Figure 14.8b. CPUE (kg/hr) by year of Lt. Dusky in EBS areas.

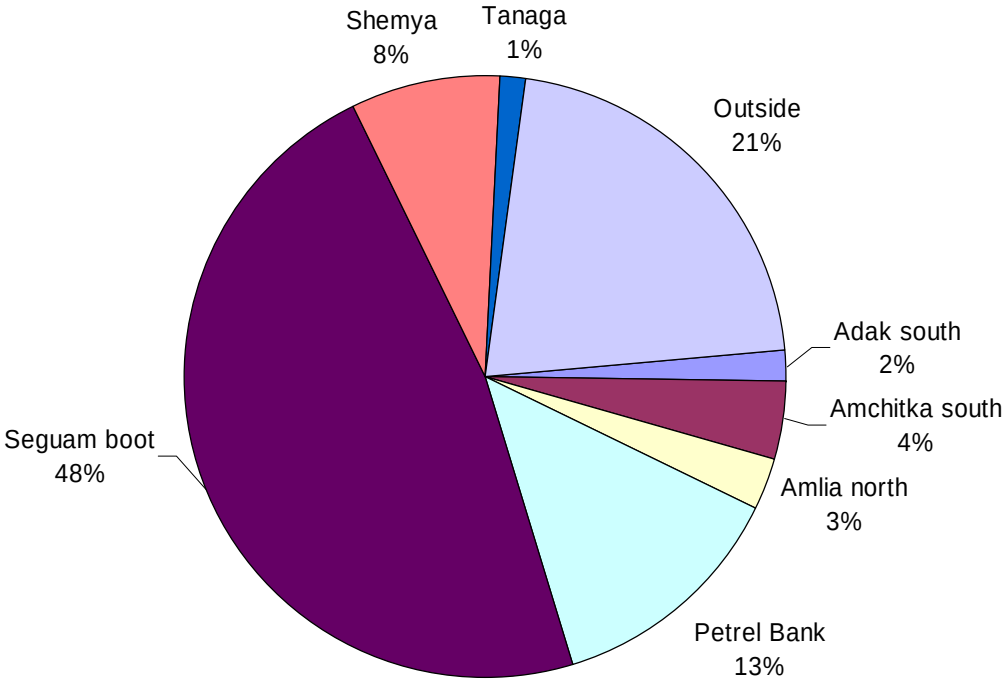


Figure 14.9a. Proportion of Lt. Dusky catch inside and outside AI savings areas.

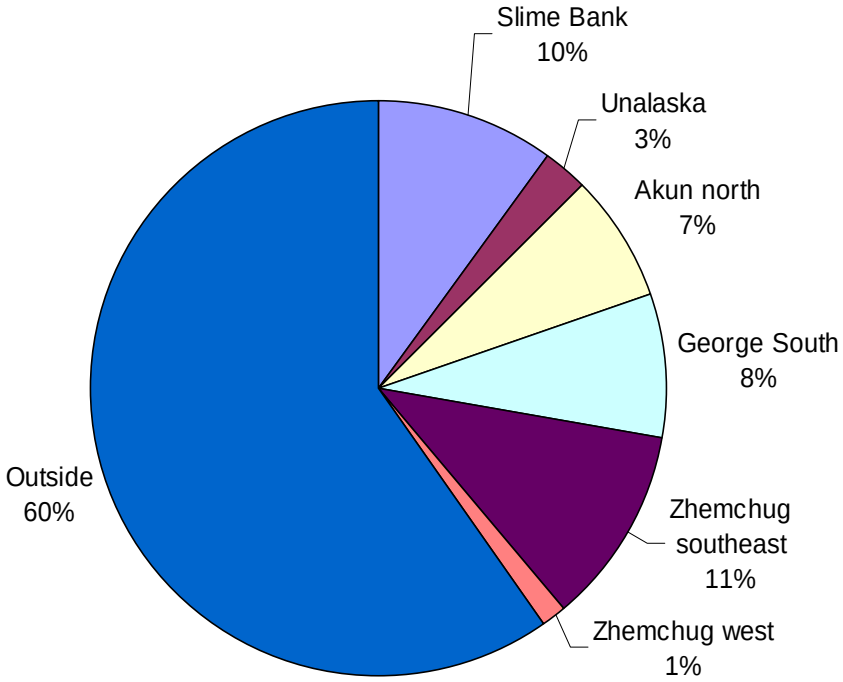


Figure 14.9b. Proportion of Lt. Dusky catch inside and outside EBS savings areas.

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